WHAT IS CLAIMED IS:

1. A method of identifying potentially therapeutically effective anticancer agents by determining the ability of one or more test compounds to selectively and differentially activate the apoptosis cascade in viable cultured cancer cells having an intact cell membrane when the cells are exposed to the test compound(s) for a predetermined period of time at a predetermined temperature, wherein a test compound is determined to have potential therapeutic efficacy if said caspase cascade activity is enhanced in response to the presence of said test compound.

2. A method for identifying selective anticancer agents, comprising

determining the ability of one or more test compounds to activate the apoptosis cascade in a first viable cultured cancer cell line having an intact cell membrane when the cells are exposed to the test compound(s) for a predetermined period of time at a predetermined temperature; and

determining the ability of one or more test compounds to activate the apoptosis cascade in a second viable cultured cancer cell line having an intact cell membrane when the cells are exposed to the test compound(s) for a predetermined period of time at a predetermined temperature;

wherein a test compound is determined to be a selective anticancer agent when the caspase cascade activity is enhanced in response to the presence of said test compound in only one of the cell line.

3. A method for identifying selective anti-cancer agents comprising obtaining at least one population of viable cultured cancer cells of a first type having intact cell membranes from a cell growth medium under conditions conducive to growth; combining a first portion of the at least one population with a predetermined amount of at least one test compound dissolved in a solvent for a predetermined period of time at a predetermined

temperature thereby generating a first volume; combining a second portion of the at least one population with an amount of the solvent which was used to dissolve the at least one test compound, for the predetermined period of time at the predetermined temperature thereby generating a second volume; separately adding to each of the first volume and the second volume a reporter compound having at least one measurable property which is responsive to the caspase cascade; measuring the at least one measurable property of the reporter compound in the first volume and thereby measuring the caspase cascade activity of the first volume; measuring the at least one measurable property of the reporter compound in the second volume and thereby measuring the caspase cascade activity of the second volume; calculating a first ratio of caspase cascade activity measured for the first volume to the caspase cascade activity measured for the second volume; and comparing the first ratio to at least one second ratio obtained with at least one second type of cultured cancer cells, and identifying those test compounds that have higher ratios for certain types of cultured cancer cells and are selective therefor.

4. The method of any one of claims 1-3, further comprising determining the cancer cell viability with or without the test compound.

5. A method for identifying a selective anti-cancer agent, comprising obtaining at least one population of viable cultured cancer cells having intact cell membranes from a cell growth medium under conditions conducive to growth; combining a first portion of the at least one population with a predetermined amount of at least one test compound dissolved in a solvent for a predetermined period of time at a predetermined temperature thereby generating a first volume; combining a second portion of the at least one population with an amount of the solvent which was used to dissolve the at least one test compound, for the predetermined period of time at the predetermined temperature thereby generating a second volume; separately assessing the cell viability of the first volume and the second volume; and

comparing the cell viability of the first volume to the cell viability of the second volume, wherein when the cell viability of the first volume is less than the cell viability of the second volume, the at least one test compound selectively kills the cancer cells and is identified as a selective anti-cancer agent.

6. The method of claim 5, wherein cell viability is assessed by observing mitochodrial activity, membrane intactness, or cell number.

7. The method of claim 6, wherein mitochondrial activity, membrane intactness, or cell number is measured by using fluorescence methodology, colorimetric assays, or direct visualization techniques.

8. The method of claim 5, wherein cell viability is assessed by contacting the cells with a reporter compound selected from the group consisting of a fluorogenic compound that produces fluorescence under the influence changes in mitochondrial activity, membrane intactness, or cell number; a chromogenic compound that produces light absorption under the influence of changes in mitochondrial activity, membrane intactness, or cell number; and a chemiluminescent compound that produces light emission under the influence of changes in mitochondrial activity, membrane intactness, or cell number.

9. The method of any one of claims 1-3, further comprising determining the ability of the agent to arrest the cell cycle during a particular phase prior to apoptosis

10. The method of claim 9, wherein the ability of the agent to arrest the cell cycle at a particular phase is determined by combining a first portion of the cells with a predetermined amount of at least one test compound dissolved in a solvent for a predetermined period of time at a predetermined

temperature thereby generating a first volume; and determining at what phase the cell cycle is arrested.

11. The method of any one of claims 1-3, further comprising determining the ability of the agent to inhibit or enhance tubulin polymerization.

12. The method of claim 11, comprising contacting a first sample of tubulin with a predetermined amount of at least one test compound dissolved in a solvent for a predetermined period of time at a predetermined temperature thereby generating a first volume; separately combining a second sample of tubulin with an amount of the solvent which was used to dissolve the at least one test compound, for the predetermined period of time at the predetermined temperature thereby generating a second volume; and comparing the extent of polymerization of the first and second samples of tubulin and thereby determining wherein the test compound inhibits or stabilizes the polymerization of tubulin.